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# Development of blended RTS from pomegranate and grapes

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**Abstract**
Pomegranate is a commercially important fruit grown throughout the world. Its juice makes a delicious drink which is very nutritious, and useful due to its medicinal value. Juice blending not only improves quality and nutrition of basic raw material, but also offers to develop the new product. In this context highly nutritious pomegranate juice is blended with grapes in different ratio and they are analysed for variation in pH, ascorbic acid, anthocyanin, sugars and total antioxidant activity after blending. Blended RTS with 50 per cent pomegranate and 50 per cent grapes was found to be the best in terms of its sensory attributes like colour, flavour, taste and overall acceptability and in terms of biochemical composition consisting of 13°Brix TSS, 3.63 pH, 1.62mg/100 ml ascorbic acid, 2.95 mg/100 ml anthocyanin and 6.75 mg AEAC/100 ml antioxidants. Nutritional properties of the blended RTS increased with the addition of pomegranate indicating that the blending of pomegranate with other fruits increases its health benefiting properties.

**Keywords:** Pomegranate, grapes, RTS, sensory evaluation

## 1. Introduction
Pomegranate is one of the important dessert fruit crops cultivated in tropical and subtropical regions of the world. The pomegranate (*Punica granatum* L.) belongs to the Punicaceae family. It is also known as the chinese apple or Apple of carthage or apple with many seeds. Pomegranate is known as a super fruit of next generation and is a native of Iran to Himalayan region and is extensively grown in Iran, Spain, India and USA as well as in most Near and Far East countries (Schubert *et al.*., 1999) [25].

Pomegranate flesh contains 10 mg calcium, 44 mg magnesium, 70 mg phosphorus, 133 mg potassium, 1.79 mg Iron, 0.90 mg sodium, 0.82 mg zinc, 0.77 mg manganese, 0.44% copper, 16 mg vitamin C, 78 % moisture, 1.6% protein, 14.6% total sugar, 0.7% ash per 100 g (Chavan *et al.*., 1995) [10]. Fruit quality depends largely on sugar and acid content of the juice. The edible portion of the portion of pomegranate is an excellent dietary source as it contains a significant proportion of organic acids, soluble solids, polysaccharides, vitamins, fatty acids and mineral elements of nutritional significance (Table 1) (Ewaida *et al.*., 1987; Fadavi *et al.*., 2006) [15, 16]. The physicochemical properties of pomegranate fruit cultivars have reported by several researchers (Artes *et al.*., 2000a; Opara *et al.*., 2009; Zarei *et al.*., 2010) [4, 1, 33]. Several chemical properties such as anthocyanins, vitamin C, total phenolics and total tannins have also been reported by Al-Said *et al.*. (2009) [1] and D'Aquino *et al.*. (2010).

The pomegranate can be processed into products like minimally processed fresh arils, juice, squash, beverage, molasses, juice concentrates, frozen seeds, jam, jelly, marmalades, grenadine, wine, seeds in syrup, pomegranate spirits, pomegranate powder, pomegranate rind powder, anardana, confectionery, pomegranate seed oil *etc*., (Yadav *et al.*., 2006) [32].

Grape (*Vitis vinifera L*.) is one of the most important, delicious and refreshing sub tropical fruit of the world also grown successfully in the tropical and temperate areas of the world, as a commercial crop. It is the earliest fruits known to mankind and closely associated with history of human civilization. It is grown for its juicy and tasty berries. Grape fruit contains various nutrient elements, such as vitamins, minerals, carbohydrates, edible fibers and phytochemicals. Polyphenols are the most important phytochemicals in grape because they possess many biological activities and health-promoting benefits (Shrikhande, 2000; Silva *et al*..1991; Silva., 2007) [26, 28].

The phenolic compounds mainly include anthocyanins, flavanols, flavonols, stilbenes (resveratrol) and phenolic acids (Dopico., *et al.* 2008; Novaka., *et al.* 2008; Spacil. *et al.* 2008) [14, 21, 29]. Anthocyanins are pigments, and mainly exist in grape skins. Anthocyanins are the main polyphenolics in red grapes (Chacona., *et al.* 2009; Bagchi.,*et al.* 2000; Cantos *et al.* 2002) [9, 5, 8]. The berries are good source of sugar, acid, minerals like Ca, Mg and Fe and vitamins like B1, B2 and C. Grapes are used as table fruit, wine, juice and raisin. The second very important ingredient in grape is a nutritive and palatable desert fruit. The cultivated types of grapes are classified into table grapes, juicy grapes and raisin grapes (Maiti, 2007) [19]. Since ancient it is known for beverage.

Blending of fruit juices is practiced to overcome the high cost of some exotic fruit juices, scarcity or seasonal availability, balancing of strong flavors, high acidity, astringency, or bitterness, improving total soluble solids, bland flavor, improving and stabilizing color. Nutritional or phytochemical properties can be improved by blending which offers to adjust sugar/acid ratios and compensate undesirable juice consistency.

**Table 1:** Physico-chemical composition of pomegranate and grapes

| S. No | Parameters | Pomegranate | Grapes |
|---|---|---|---|
| 1 | TSS (°Brix) | 13.70 | 14.10 |
| 2 | pH | 3.65 | 3.78 |
| 3 | Acidity (%) | 0.80 | 0.75 |
| 4 | Ascorbic acid (mg $100g^{-1}$) | 10.04 | 7.37 |
| 5 | Total antioxidants activity (mg AEAC $100g^{-1}$) | 58.00 | 32.00 |
| 6 | Reducing sugars (%) | 9.11 | 11.60 |
| 7 | Non reducing sugar (%) | 3.16 | 2.90 |
| 8 | Total sugar (%) | 12.27 | 14.50 |
| 9 | Anthocyanin (mg $100g^{-1}$) | 17.00 | 29.00 |
| 10 | Length (mm) | 66.00 | 19.40 |
| 11 | Diameter ( mm ) | 75.00 | 17.45 |
| 12 | Weight (g) | 298.00 | 3.80 |
| 13 | Juice recovery (%) | 53.17 | 79.60 |

(Bates *el al.*, 2011) [6]. Therefore, in present study attempt has been made to optimise level of pomegranate and grapes juice to prepare blended product which is having high nutritional value.

## 2. Material and Methods

The experiment was carried out at the Department of Postharvest Technology, College of Horticulture, University of Horticultural Sciences Campus, GKVK (Post), Bengaluru, during the year 2017-18. Bahgwa variety of Pomegranate and Bangalore blue variety of grapes used in this experiment procured from farmer's field near Devanahalli, Bangalore. Fruits of uniform maturity, size and shape, free from bruises, injuries and damages were selected for the experiment.

### 2.1 Extraction of juice

Pomegranate fruits were cut open using a knife discarding the peel adhering to the placenta and the arils were carefully separated. The arils so separated were extracted through carrot juice extractor and filter through muslin cloth. The grapes berries were thoroughly washed in clean water. The washed berries were separated from the bunch and were crushed by hand pressing and filtered with the help of muslin cloth. Both the extracted juices were centrifuged at 5000 rpm for 5 minutes and obtained clear juice was used in the present study.

Pomegranate and grapes juices were blended in different ratios, 100:0, 80:20, 60:40, 50:50,40:60, 20:80, 0:100. Further, blended juice was used for preparation of RTS as per the following recipes (Table 2).The required quantity of RTS was prepared by mixing of pomegranate, grapes juice and water as per the treatments. Total soluble solid of 13°Brix was maintained in the juice by adding desired quantity of sugar for all the treatments. The prepared juice was filled in 200 ml capacity pre sterilized glass bottles. Chemical and sensory qualities of the prepared juice was studied.

**Table 2:** Recipe for blended RTS

| Treatments | Juice (%)* | TSS$^{O}$B | Acidity (%) |
|---|---|---|---|
| 1 | 15(100: 0) | 13 | 0.3 |
| 2 | 15(80:20) | 13 | 0.3 |
| 3 | 15(60:40) | 13 | 0.3 |
| 4 | 15(50:50) | 13 | 0.3 |
| 5 | 15(40:60) | 13 | 0.3 |
| 6 | 15(20:80) | 13 | 0.3 |
| 7 | 15(0:100) | 13 | 0.3 |

* Juice blending (pomegranate: grapes)

### 2.2 Biochemical Analysis

Biochemical properties of blended RTS was studied with the following parameters, material and methodologies were followed are as given below. Total soluble solids (TSS), determined with the help of digital hand refractometer (ATAGO, model:PAL-1) and expressed as degree Brix (°B). Digital pH meter (UITRANS, model: BP 3001) was used to measure the pH of the products. Total titratable acidity of blended juice was determined by visual titration method as explained by Cohen (1971) [11], spectrophotometric method was followed for estimation of ascorbic acid of blended RTS product as described by William (2006) [31] using 2, 6-dichlorophenol indophenol sodium salt with slight modification. Total monomeric anthocyanin content was quantified using a pH differential method described by Giusti and Wrolstad (2003) [17]. Total antioxidant activity of blended beverages was determined by the FRAP method explained by Benzie and Strain (1996) [7], Sugars present in the blended juice were estimated, following the method outlined by Lane and Eynon described by Ranganna (1977) [24] with some modifications. Organoleptic evaluation of blended RTS was conducted on the basis of colour, aroma, texture, taste, after taste and overall acceptability by a panel of ten judges using a nine point Hedonic scale as laid out by Amerine *et al.*. (1965) [2]. Completely Randomized Design (CRD) was used for Analysis of the experimental data and results were analysed as per the guidelines suggested by Panse and Sukhatme (1978) [23].

## 3. Results and Discussion

The results obtained during present investigation are presented and discussed under suitable headings in view of available relevant scientific literature. Quality composition of RTS was varied with respect to different combination of pomegranate and grapes.

**Table 3:** Biochemical composition of blended RTS from pomegranate and grapes

| Treatment | pH | Ascorbic acid (mg 100 ml$^{-1}$) | Anthocyanin (mg CGE100g$^{-1}$) | Total antioxidant activity (mg AEAC 100ml$^{-1}$) | Total Sugar (%) | Reducing Sugars (%) | Non Reducing Sugar (%) |
|---|---|---|---|---|---|---|---|
| $T_1$ | 3.62 | 1.82 | 2.50 | 8.81 | 11.30 | 8.39 | 2.90 |
| $T_2$ | 3.62 | 1.75 | 2.73 | 7.99 | 12.22 | 8.89 | 3.33 |
| $T_3$ | 3.63 | 1.65 | 2.89 | 7.23 | 11.60 | 8.57 | 3.03 |
| $T_4$ | 3.63 | 1.61 | 2.95 | 6.75 | 12.56 | 9.29 | 3.27 |
| $T_5$ | 3.64 | 1.58 | 3.06 | 6.40 | 12.39 | 9.12 | 3.26 |
| $T_6$ | 3.67 | 1.56 | 3.28 | 5.58 | 11.86 | 8.71 | 3.16 |
| $T_7$ | 3.73 | 1.49 | 3.45 | 4.54 | 11.71 | 8.49 | 3.23 |
| SE.m ± | 0.02 | 0.02 | 0.14 | 0.14 | 0.36 | 0.25 | 0.35 |
| CD @ 5% | 0.06 | 0.07 | 0.41 | 0.41 | 1.10 | 0.77 | 1.07 |
| F test | * | * | * | * | NS | NS | NS |

NS- Non Significant* - Significant

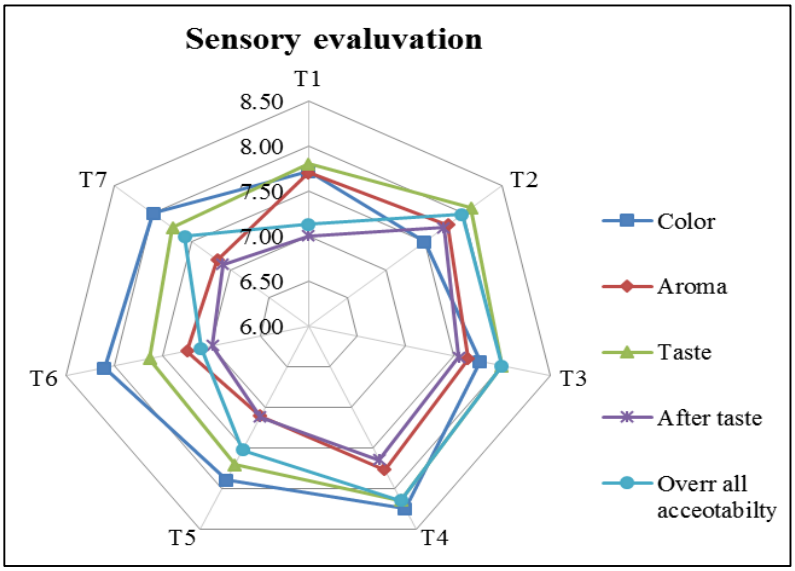


**Fig 1:** Sensory scores of blended RTS from pomegranate and grapes

The biochemical composition of prepared blended RTS in this experiment is given in the Table 3. The TSS of all the treatments was maintained at 13°Brix and acidity 0.30 per cent.

Different parameters like pH, ascorbic acid, anthocyanin, antioxidants, reducing, total and non-reducing sugars were determined. The data revealed that there was no significant difference observed in reducing, total and non-reducing sugars content in respect to all the treatments.

### 3.1 pH

Table 3 revealed that, the pH of all the treatments were significantly differed. The highest pH (3.73) was observed in the $T_7$ having 100 per cent grapes juice in the blend, followed by $T_6$ having pH 3.67 containing 20 per cent pomegranate and 80 per cent grapes. Whereas, the lowest pH 3.60 was recorded in the $T_1$ having 100 per cent pomegranate. It was observed that, with the addition of pomegranate the pH of the juice decreased significantly. This might be due to the comparative acidic nature of pomegranate which decreases the pH of the RTS. The edible portion of the pomegranate contains a significant proportion of organic acids (Ewaida and Fadavi *et al.*.) Similarly, sweet arrange and pomegranate blend prepared by Manoj *et al.*., (2014) observed that significantly higher ascorbic acid content in sweet orange and pomegranate (60:40) blended RTS beverage (T4), while least ascorbic acid content was found in sweet orange RTS beverage (T6). Low pH of the fruit is attributed by the presence of high ascorbic acid content and titratable acidity as showed in the Table 1. Similar findings were reported by Joshi *et al.*. (1991) in the preparation of plum appetizer; Deka (2000) [13] in mango-pineapple, lime aonla and guava mango RTS blends; Siddharth and Ajaykumar (2013) [27] in concord grape juice blended with kokum. Where they found that the decrease in pH of the blended product by increasing the proportion of the fruits which are rich in organic acids.

### 3.2 Ascorbic acid (mg 100 ml$^{-1}$)

As presented in Table 3, the highest ascorbic acid content of 1.82 mg 100 ml$^{-1}$ was found in $T_1$ (100% pomegranate) which is on par with $T_2$ (80% pomegranate and 20 % grapes). The lowest ascorbic acid content of 1.49 mg 100 ml$^{-1}$ was found in $T_7$ (100% grapes). It was observed that with the addition of pomegranate the ascorbic acid content of the juice increased. This could be due to the influence by ascorbic acid content of pomegranate. Fruit quality depends largely on sugar and acid content of the juice. The edible portion of pomegranate is an excellent dietary source as it contains a significant proportion of organic acids, soluble solids, polysaccharides, vitamins, fatty acids and mineral elements of nutritional significance (Ewaida *et al.*., 1987; Fadavi *et al.*., 2006) [15, 16]. This organic acid also influenced on pH of the RTS as discussed in earlier section. Similar observations were recorded by Deka (2000) [13] in mango-pineapple, lime aonla and guava mango RTS blends, which are rich in organic acids.

### 3.3 Anthocyanin (mg CGE100g$^{-1}$)

The changes in anthocyanin content showed significant difference among treatments. The higher anthocyanin content of 3.45 mg 100 ml$^{-1}$ was recorded in $T_7$ (100 % grapes)

followed by $T_6$ (3.45 $ml^{-1}$) ( Table 3). The lower anthocyanin content 2.43 mg 100 $ml^{-1}$ was recorded in $T_1$ (100% pomegranate). It was observed that, with the addition of grapes, the anthocyanin content of the juice increased. Anthocyanins are pigments, and mainly exist in grape skins. Anthocyanins are the main polyphenolics in red grapes [7–9]. Bengalore blue grape is rich in anthocyanin and polyphenols (Mamatha *et al..*, 2017). Therefore, in our study, treatment, $T_7$ was having high anthocyanin content. Analogous results were reported by Siddharth and Ajaykumar (2013) [27] in concord grape juice blended with kokum, as concord grape is rich in anthocyanine.

### 3.4 Total antioxidant activity (mg AEAC 100 $ml^{-1}$)

Total antioxidant activity was significantly different among the treatments (Table 3). The highest antioxidant activity of 8.81 mg AEAC 100 $ml^{-1}$ was recorded in $T_1$ (100% pomegranate) followed by $T_2$ (7.99 mg AEAC 100 $ml^{-1}$). The lower antioxidant activity of 4.54 mg AEAC 100 $ml^{-1}$ was observed in $T_1$ (100 per cent grapes). As the pomegranate level increased in the beverages the antioxidant activity of the blended beverage increased, indicating that the higher the level of pomegranate juice and more is the antioxidant activity. This higher antioxidant activity might be contributed by the presence of comparatively high ascorbic acid content in pomegranate (Table 1), which is called as strong antioxidant molecule, in addition to this other phytochemicals might have also contributed to this property. As pomegranate is rich source of phytochemicals viz., vitamin C, total phenolics and total tannins reported by Al-Said *et al..* (2009) [1] and D'Aquino *et al..* (2010), these are well known for their antioxidant property. Similar findings were reported by Griffin (1992) [18].

### 3.5 Sensory evaluation of blended RTS from pomegranate and grapes

#### 3.5.1 Colour

The sensory scores obtained for RTS beverages prepared by blending pomegranate and grapes are given in Figure 1. The highest score for colour (8.25) was recorded for T4 consisting of 50 per cent pomegranate + 50 per cent grapes followed by T6 (8.11) having (20% pomegranate and 80% grapes). The lowest score (7.50) was observed in $T_2$ having 80 per cent pomegranate and 20 per cent grapes. The organoleptic score for colour of all the treatments were influenced by the blending ratio of juice. Treatment having equal ratio of pomegranate juice scored higher compared to others blends this may be due to the good blending ratio of both fruit juice.

#### 3.5.2 Aroma

According to Figure 1, the highest sensory score for aroma (7.80) was observed in $T_2$ (80% pomegranate + 20% grapes) followed by $T_3$ (7.77) score. The minimum score (7.11) was recorded in $T_5$ (40% pomegranate and 60% grapes) followed by $T_7$ (100% grapes). Aroma scores was observed higher in the products prepared with high level of pomegranate juice. Treatments having high per cent of grapes juice scored less. It might be due to less aroma of grapes juice which might have masked the other aroma.

#### 3.5.3 Taste

The highest score 8.15 for taste was recorded in $T_4$ (50% pomegranate + 50 % grapes) followed by $T_2$ (8.10) having 80% pomegranate and 20 % grapes juice (Figure 1). The lowest score (7.64) was received by $T_6$ having 20 per cent pomegranate and 80 per cent grapes. The highest score for taste was observed in the treatment having same ratio of both fruit juices. It might be because of best combination of pomegranate and grapes blends

#### 3.5.4 After taste

The sensory scores obtained for RTS beverage prepared by blending pomegranate and grapes are given in Figure 1. The highest score (7.75) for after taste was received by $T_2$ consisting of 80 per cent pomegranate and 20 per cent grapes followed by $T_3$ receiving score (7.65). The lowest score (6.99) was recorded in $T_6$ having 20 per cent pomegranate and 80 per cent grapes. The highest score for after taste was recorded in the treatment having thigh per cent pomegranate. This may be due to the presence of lower level of grapes which might have given the better after taste to the pallet.

#### 3.5.5 Overall acceptability

According to Figure 1, the maximum sensory score (8.15) was recorded for overall acceptability in $T_4$ (50% pomegranate, 50% grapes) followed by $T_3$ (60% pomegranate and 40% grapes) recorded 8.00 score. The minimum score (7.11) was recorded in $T_6$ (20% pomegranate and 80% grapes) followed by $T_1$ (100% pomegranate) (7.66).

Overall acceptability scores were a composite of scores for other characters because panelists were asked to keep in mind all the other sensory parameters while scoring for this parameter. The score was higher in the blend containing the equal ratio of both blends indicating that this combination might have good overall acceptability.

## 4. Conclusion

Juice blending not only improves the quality and nutrition of basic raw material, but also offers to develop the new product. Bangalore blue grape is having astringency, or bitter taste but better nutritional property, in our study we could overcome this by blending of pomegranate juice with grapes enhanced the overall acceptability of product by improving the colour, aroma, taste, after taste and overall acceptability. 50% pomegranate blended with 50% grapes TSS maintained at 13°Brix found to be the best recipe according to the sensory panellists. However, in concerned to better nutrition and health benefit the treatment, T2 (80% pomegranate and 20% grapes) has scored highest.

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